

REISSUE PATENT APPLICATION
INFORMATION DISPLAY SYSTEM FOR ELECTRONICALLY
READING A BOOK

Inventor(s): Makoto Ohara
2-9-16-816, Botan Koutouku
Tokyo 135

Hirotsugu Tomizawa
4-6-4-305, Nishikawaguchi Kawaguchishi,
Saitamaken

Shinichirou Sugiura
4-15-33-705
Shimorenzyaku Mitakashi
Tokyo 181

Assignee: Sega Enterprises

Entity: Large

INFORMATION DISPLAY SYSTEM FOR ELECTRONICALLY READING A BOOK

This is a continuation of pending U.S. Ser. No. 08/429,885, filed on Apr. 27, 1995 now U.S. Pat. No. 6,052,117, which is a continuation of U.S. Ser. No. 08/265,693, filed on Jun. 23, 1994, and issued as U.S. Pat. No. 5,485,176 on Jan. 16, 1996, which is a continued prosecution application of U.S. Ser. No. 07/952,329, filed on Sep. 28, 1992 (abandoned).

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an integration of printed text and images with a software program and a computer-driven display system and, more particularly, to an electronic book that permits the operator to designate selected indicia on pages of the book, which are then entered into the computer system for appropriate display in an audio and visual manner.

2. Description of Related Art

Electronic instruments that use cards made by printing or describing graphic images as figures, letters, codes, etc., on the surface of sheets of paper, etc., with special conductive ink or special paint, and that read the information described on such cards with a touch pen, etc., and play back audio and video signals via external instruments such as television sets have been used in the past for the purposes of play, learning, etc.

However, such cards have usually required special processing such as conductive paint, bar codes, etc., for the purpose of reading the information. The electronic cards which use conductive paint have the following problems:

1. The printing process is complicated.
2. It is difficult to render in natural colors.
3. The printed surface deteriorates, causing difficulty in reading.
4. Because a connector is necessary, electrical failure is likely to occur.
5. The bookbinding process is complicated, etc.

The electronic cards using bar codes have the following problems:

1. Because considerable space is needed for printing the bar code, the quantity of information contained in a page is therefore limited.
2. The aesthetic rendering is inhibited by the bar code.
3. If the bar code is blurred or otherwise marred, it will become difficult to read, etc.

Thus, the computer field is still seeking to provide an information display system utilizing an electronic book that can resolve the problems that have occurred in the past.

SUMMARY OF THE INVENTION

An electronic book-reading system and information storage system is capable of reading the contents of the sheets of a book having various information such as figures, letters, codes, etc., applied to the surface of the sheets in the book. The book is mounted at a fixed location, and the user can arbitrarily designate a specific location to identify the particular indicia on the sheet. A sensor system can detect the arbitrarily-designated location and, in some cases, can further employ a page detection system to detect which specific page is being addressed and whether it is the front or the back of the page. A location detection circuit can, from a

determination of an absolute location signal or a predetermined reference point, plus the arbitrarily-designated location point entered by the operator, determine which specific indicia is being designated by the operator. A ROM, that can be integrated with the electronic book or can exist separately, can be appropriately addressed on the basis of the sensor system to thereby provide the electronic information corresponding to the specific figures, letters, codes, etc., that are displayed in the electronic book. The ROM which has memorized the location of the indicia and related information at that location can be addressed and downloaded for subsequent processing, for example, through a computer-driven system that can provide audio and video images.

Various forms of location detection circuits can be utilized, such as an electromagnetic induction system which includes a transmitter for generating electro-magnetic signals to a planar panel having multiple electrodes arranged in a horizontal direction and a vertical direction at fixed locations. An X direction decoder and a Y direction decoder can be responsive to a sensor that designates an arbitrary location on the planar panel.

Alternatively, an optical system can be utilized having a grid of optical light beams defining a crossing pattern on a planar surface, with corresponding photo-receptors indicating the receipt of each light beam. A light-intercepting or blocking member can be positioned in an arbitrary location on the panel. An X direction location circuit and a Y direction location circuit can detect the relative coordinates of the blocked light beams, to thereby provide information for a detection control circuit to determine a specific arbitrarily-designated location.

Additionally, an ultrasonic system can be utilized wherein an ultrasonic generator can be used to designate coordinates within a fixed location. At least three ultrasonic sensors can receive a signal of the ultrasonic generator. From this information, a detection circuit can determine the relative location of the ultrasonic generator to designate an arbitrary position.

In addition, a page detection system is also provided wherein multiple perimeter sensors can detect the shape of the perimeter of a sheet of a book, and thereby define which page is being addressed. As can be appreciated, a ROM storing a program containing the information on the sheet can be integrated with the form of the electronic book, or it can be remotely located in a housing that can further house both audible speakers and monitors such as CRT tubes and liquid crystal displays. The individual sheets in the book can be of any configuration, such as squares, circles, clouds, etc., and is preferably of a thin body of paper or card material. While it is contemplated that the sheets will be planar, it is also possible for them to have concave or convex surfaces, or to have relief surfaces or perforated surfaces. The descriptions of the terminology "vertical direction" and "horizontal direction" are relative, and are simply stated herein for purposes of defining a coordinate system.

As can be readily appreciated, the information contained within the sheet is indirectly outputted by reading the contents of a ROM which has the same recorded information that has been mapped to define the specific location coordinates with the sheet. When the sheet is located at a fixed location, a determination of the coordinates relative to that fixed location will then identify the address of the information contained in the ROM. In some of the detection systems, the coordinates can also be defined on a time base, and a signal generated by the sensor can determine the coordinate by comparing the time base with the received signal.

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BRIEF DESCRIPTION OF THE DRAWINGS

The objects and features of the present invention, which are believed to be novel, are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

FIG. 1 is a schematic diagram of one embodiment of the present invention;

FIG. 2 is a schematic diagram disclosing one embodiment of an electromagnetic detection circuit;

FIG. 3 is a schematic diagram disclosing an alternative embodiment of an optical detection circuit;

FIG. 4 is another embodiment of an ultrasonic sound detection circuit;

FIG. 5 is a schematic diagram of a page-detection control circuit;

FIG. 6 is a schematic diagram of an information and entertainment system; and

FIG. 7 is a perspective view of an alternative embodiment of the present invention.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description is provided to enable any person skilled in the art to make and use the invention and sets forth the best modes contemplated by the inventors of carrying out their invention. Various modifications, however, will remain readily apparent to those skilled in the art, since the generic principles of the present invention have been defined herein specifically to provide an electronic book information display system.

In an electronic book-reading process or device of this invention, the following measures are adopted: the contents of the sheet or the book consisting of a number of the sheets bound together on which such information as figures, letters, codes, etc., are applied are mounted at a fixed location on a plane. An arbitrarily-assigned location within the aforementioned fixed location is detected by a location detection circuit. A page detection circuit can also detect which page is being addressed. The absolute location signal of the aforementioned arbitrarily-assigned location is obtained by a location signal detected by the location detection circuit and the page signal obtained by the page detection circuit, if necessary. The absolute location signal and the contents of a ROM in which such information as specific figures, letters, codes, etc., are preassigned and memorized for the absolute location of the sheet or book are compared, and the contents of the ROM memorized at the matched absolute location is output as the information signal. The information signal is output as at least one of either an audio or a video signal.

In addition, a device which reads the contents of the sheet or the book includes a location detection means that detects the coordinates of the sheet or the page of the book mounted at a fixed location, and a page detection means which detects the front or the back of the sheet or the page of the aforementioned book. An absolute location detection circuit detects an absolute location by a location signal obtained by the location detection means and the page signal obtained by the page detection means, and obtains the absolute location signal. A control device having a control circuit compares the contents of the ROM in which the information for the absolute location of the sheet or book is stored beforehand and the absolute location signal obtained by the absolute

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location detection circuit, and outputs the information at the matched location as the information signal. This information can be output as at least either an audio or a video signal to an output playback device which plays back the output of the control circuit.

The location detection means can be an electromagnetic induction system, composed of a transmitting part which generates electromagnetic signals, a planar panel having multiple electrodes arranged in a horizontal direction and a vertical direction at a fixed location, an X direction decoder and a Y direction decoder which provide the electromagnetic signals to the electrodes successively, a receiving part which detects the electromagnetic signal when it is near the planar panel, and a detection control circuit which obtains the location signal of the coordinate in the planar panel by a sending signal from the transmitting circuit and the reception signal obtained from the receiving circuit.

Alternatively, the location detection means can be an optical system, composed of multiple emission parts, each set in the vertical direction and the horizontal direction surrounding a fixed location, a light-intercepting part which detects the light from each of the emission parts, an X direction location detection part which detects the shaded state of the light at the vertical direction light-intercepting part and comprises the vertical detection signal, a Y direction location detection part which detects the shaded state of the light at the horizontal direction light-intercepting part and comprises the horizontal detection signal, and a detection control circuit which obtains the location signal of the coordinates within the fixed location by the vertical detection signal and the horizontal detection signal.

The location detection means can include an ultrasonic system composed of an ultrasonic generator which can assign coordinates within a fixed location, at least three ultrasonic sensors which receive the signal of the ultrasonic generator, a receiving part which receives each of the multiple ultrasonic reception signals from the ultrasonic sensors and outputs the reception signal, a transmitting part which supplies the ultrasonic signal to the ultrasonic generator by a sending signal, and a detection control circuit which obtains the location signal of the assigned coordinates within a fixed range by the reception signal and the sending signal.

The page detection means can be composed of multiple perimeter sensors which detect the shape of the perimeter of the sheet or a book consisting of a number of sheets bound together, and a page detection control circuit which determines the page by detecting the state of the multiple perimeter sensors.

Referring to FIG. 1, an electronic book and information processing system is disclosed wherein the electronic book 2 is positioned at a fixed location on a housing of the reading device 4. A location detection sensor system 6 extends across the top and left side of the electronic book. A page detection system 8 is also provided across the bottom and right side of the electronic book. Respective outputs from the location detection system 6 on line 10 and the page detection system 8 on line 12 are forwarded to an absolute location detection circuit 14. Thus, if the user designates particular coordinates within the electronic book 2, these coordinates are detected by the location detection system 6 and sent to the location detection circuit 14 as a location signal. In addition, the page detection system can detect a specific page 16, and a page signal can be sent to the absolute location detection circuit 14. If the insert into the reading device 4 is simply a sheet, the page detection circuit will output a page signal indicating no pages.

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The output of the location detection circuit provides information of the designated coordinates within the page of the electronic book 2. The contents which are printed on the surface of the book 2, or the information to which it is related, are stored relative to the coordinates of each page of the book 2 in a ROM 24. The contents of this ROM are addressed to match the coordinates of the absolute location signal. The control circuit 18 can retrieve the information from those addresses in the ROM 24 and use them to drive a video drive circuit 20 and/or an audio drive circuit 22. The ROM 24 is shown remote from the electronic book 2, but could be integrated physically with the electronic book 2. A video signal from the video drive circuit 20 can drive a video display 26, which can take the form of an LCD display, a CRT monitor, etc.

Additionally, the video display can be integrated into a unitary cabinet 30 or it can be remote, and a television receiver can be driven. The audio drive circuit 22 can also appropriately drive a speaker 28, which can again be integrated into a unitary cabinet 30 or can be remote. For example, the combination of the video display and speaker can be considered to be an output playback device 30 that can be a stand-alone unit. The video signals and the audio signals are only output if they are recorded in the ROM. It is natural that sometimes it will be only image or only sound, and sometimes it can be a combination of both.

Referring to FIG. 2, a schematic is disclosed of one form of location detection system 6. In this embodiment, an electromagnetic induction system is utilized, and comprises a grid pattern of multiple vertical electrode wires 32 that cross multiple horizontal electrode wires 34. This grid pattern constitutes a planar panel 36. An X direction decoder 38 and a Y direction decoder 40 are, respectively, connected to a transmitter circuit 42. The X direction decoder 38 adds the vertical electromagnetic signals from each of the vertical electrodes in sequential order. In a similar manner, the Y direction decoder 40 adds the horizontal electromagnetic signals from each of the horizontal electrodes in sequential order. A pickup sensor 44 includes a coil which can sense an electromagnetic signal when applied to the planar panel 36.

By placing the pickup sensor 44 adjacent the planar panel 36, it can sense the vertical electromagnetic signal and the horizontal electromagnetic signal that are applied to the respective wire electrodes 32 and 34. These signals are added together, and are then transmitted to a receiver circuit 46. A detection control circuit 48 controls the timing sequence of the electromagnetic signal applied to the vertical electrodes 32 and to the horizontal electrodes 34, respectively. It can thereby determine, from the input from the receiver circuit 46, based upon the same time interval (same clock base), the location of the coil on the pickup sensor 44 adjacent the planar panel 36. Thus, the fixed location is obtained and output as the location signal on line 50.

Referring to FIG. 3, another schematic drawing is provided of an alternative location detection system. This system is basically an optical system using a linear principle of light. In the vertical direction, arrow A, and the horizontal direction, arrow B, are a series of light emitters 52 and 54, respectively. These respective light emitters emit a grid pattern of light beams to correspondingly-located photodiode receivers 56 in the horizontal plane and photodiode receivers 58 in the vertical plane. A Y detector circuit 60 is connected to the light receiver array 58, while an X detector circuit 62 is connected to the light receiver array 56. The outputs from these respective detection circuits 60 and 62 are directed to a detection control circuit 64 to provide the coordinates of any blocking interference with the light grid.

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As can be appreciated, a pointer, or even a finger, can be inserted into the grid pattern of light, to thereby block a vertical and horizontal light beam. By sequentially polling each of the light receiver arrays, the location of the blocked beam can be ascertained, and the coordinates of that position can be determined. This information can then be used to address, for example, a ROM to determine the appropriate stored information for that designated area. As can be appreciated, in operation, the page of the book should be inserted underneath the light grid, and the light grid should have a sufficient number of light beams to accommodate the necessary coordinate system. That is, a fine pattern may require a denser light grid than a coarser pattern would require.

Referring to FIG. 4, an alternative location-detecting system is disclosed, wherein the electronic book 2 has a series of ultrasonic sensors 66 positioned at locations spaced around the electronic book 2. An ultrasonic generator 68 is connected to a transmitter circuit 70 which is capable of generating ultrasound when contacting the surface of the electronic book 2. The ultrasonic sensors 66 will receive the ultrasound signal from the ultrasound generator 68 and will relay it to a receiver circuit 72. The output from the receiver circuit 72 is provided to a detection control circuit 74. The ultrasonic signal that is transmitted to the ultrasonic generator is controlled by the detection control circuit 74, and appropriate modulation of the signal can be added if necessary. The detection control circuit 74 can detect the coordinates of the fixed location specified by the ultrasonic generator 68 by comparing each set location of the ultrasonic sensor 66 on a time basis, and thereby derive a location signal.

Referring to FIG. 5, a page detection system is disclosed wherein the ultrasonic book 2 has a series of sheets or pages 76 having peripheral notches 78 along the vertical edge of the pages. These notches are coded to identify a specific page. Thus, the notch pattern is unique to a specific page. Perimeter sensors 80 are mounted adjacent one edge of the page detection system and coordinated with the alignment of the notches 78 on the pages 76. These perimeter sensors 80 can detect the light passing through the notches to produce an appropriate signal indicating which page is open. For example, if the light has passed through only three notches, then it can be easily determined that a page 82 is positioned across the sensors 80. A page detection control circuit 84 can poll the sensors and determine which page is being exposed. As can be readily appreciated, various kinds of page settings can be assigned by number, interval, etc., related to the perimeter of the page, to distinguish between the pages.

Referring to FIG. 6, a schematic drawing of a variation of the embodiment of FIG. 1 is disclosed, wherein a ROM 86 is integrated directly into the electronic book 2. In this regard, a connector 88 is used to connect the ROM 86 with the control circuit 18. Each of the other elements are the same, as set forth in the embodiment of FIG. 1.

As can be readily appreciated, the video display 26 and the speaker 28 can also be integrated with the computer control system as a unitary display device. The display could have a built-in liquid crystal display or a CRT monitor, and can also have a built-in speaker. Alternatively, external speakers and independent television monitors can also be used.

Referring to FIG. 7, an embodiment of the present invention is disclosed in the format of a drawing system toy for small children with an electronic book reading device of the present invention.